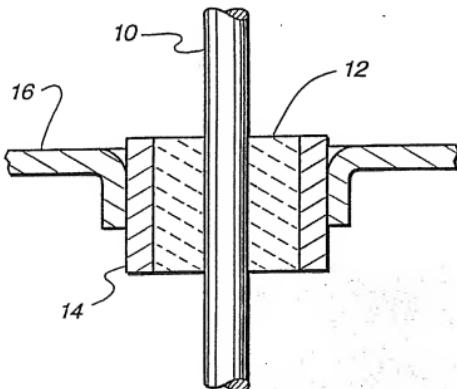




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(54) Title: CORROSION RESISTANT FEEDTHROUGH



(57) Abstract

Use of Titanium and Titanium alloys (14) in combination with and CABAL-12 glass (12) for improved corrosion resistant feedthroughs.

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CORROSION RESISTANT FEEDTHROUGH

Background of the Invention

Glass seals are used in various arrangements including batteries and other electrochemical cells. For example, in battery headers, glass seals are used to seal the battery container while allowing one or more electrical terminals to extend through the seal for interior/exterior connection thereto. The term "feedthrough" shall be used herein to describe such arrangements in generic fashion.

In batteries and the electrochemical cells, corrosion has been encountered. For example, batteries which include various organic electrolyte systems give rise to corrosion and cracking of glass and metal feedthrough components.

A special glass composition has developed by Sandia National Laboratories which exhibit improved corrosion resistance. It is generally referred to as CABAL-12 glass. Although this glass has desirable corrosion resistance and resistance to cracking, it has been difficult to find metals which will reliably wet the glass to form strong, hermetic seals with it and which work well with respect to the other aspects of seal forming such as weldability, expansion characteristics and so forth. The general purpose of this invention is to provide a combination of metal and CABAL-12 GLASS for improved feedthrough structures in battery and electrochemical cell applications.

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1 Summary of the Invention

2 This invention relates to feedthrough
3 structures which utilize CABAL-12 glass particularly for
4 use in aggressive battery organic electrolyte
5 environments e.g., a lithium thionyl chloride cell or
6 cells of other active chemistries such as MnO_2 , and CFX,
7 for example. It has been discovered that this glass has
8 a unique affinity for sealing to titanium and titanium
9 alloys. In its preferred embodiment the invention
10 relates specifically to hermetic, corrosion resistant,
11 compression-type sealed feedthroughs utilizing single or
12 multiple terminals or pins of niobium, tantalum,
13 molybdenum and titanium or alloy thereof, contained
14 within a header or sleeve of titanium or a titanium
15 alloy, Titanium-6Al-4V being preferred.

16 Brief Description of the Drawing

17 Fig. 1 is a schematic cross-section of a
18 battery header in accordance with the invention, and

19 Fig. 2 is a schematic cross-section of a
20 feedthrough with sleeve according to the invention
21 combined with a metal container for use as an
22 electrochemical cell.

23 Description of the Preferred Embodiments

24 While this invention may be embodied in many
25 different forms, there are shown in the drawings and
26 described in detail herein specific preferred embodiments
27 of the invention. The present disclosure is an
28 exemplification of the principles of the invention and is
29 not intended to limit the invention to the particular
30 embodiments illustrated.

31 Referring to Fig. 1, a header of typical
32 construction is shown which includes a center pin or
33 terminal 10, a glass seal member 12 and an outer member
34 14. This arrangement and that of Fig. 2 are typical
35 feedthrough seal arrangements which may make use of the
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1 invention. Other arrangements may be used as well and
2 may take any configuration in which the metal is wetted
3 by the glass.

4 Referring now to the Fig. 2 the invention in a
5 preferred form includes a terminal 10 extending through
6 a glass seal 12 which is received into a sleeve or header
7 14. Sleeve 14 may be welded into an opening in a battery
8 container 16 of, for example, stainless steel.

9 The assembly, requiring forming weights, is
10 placed in an oven or furnace and heated causing the glass
11 to wet the metallic components forming a hermetic seal
12 between the glass and the metal components. Such a
13 feedthrough may thereafter be welded if necessary, into
14 any desirable container or the like.

15 In its preferred form, terminal 10 consists
16 essentially of niobium, or titanium or an alloy thereof.
17 Sleeve 14 is of titanium or a titanium alloy Ti-6Al-4V
18 The glass 12 is CABAL-12, which is of the following
19 composition:

	<u>Composition</u>	<u>Wt. Mt.</u>
21	Al ₂ O ₃	20
22	B ₂ O ₃	40
23	CaO	20
24	MgO	20

25
26 The combination of materials described forms a
27 compression seal which is hermetic and corrosion
28 resistant.

29 This completes the description of the preferred
30 and alternate embodiments of the invention. Those
31 skilled in the art may recognize other equivalents to the
32 specific embodiments described herein, which equivalents
33 are intended to be encompassed by the claims attached
34 hereto.

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1 Having described the invention, the exclusive
2 rights and privileges thereto are to be defined by the
3 foregoing claims in the light of the foregoing
4 description.

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1 WHAT IS CLAIMED IS:

2 1. An electrical feedthrough comprising an
3 electrical terminal selected from the group consisting of
4 niobium, tantalum molybdenum, Titanium, titanium alloys,
5 or alloys of any of the foregoing, a glass insulator of
6 the CABAL-12 composition Type positioned around a portion
7 of the terminal and in sealing engagement therewith and a
8 sleeve or header comprised of a titanium or a titanium
9 alloy positioned around a portion of the glass insulator
10 for receiving same in sealing engagement therewith.

11 2. The feedthrough of Claim 1 in which the sleeve
12 or header titanium alloy is Ti-6Al-4V.

13 3. A glass/metal feedthrough seal of the
14 compression type including an electrical terminal
15 selected from the group consisting of niobium, tantalum,
16 molybdenum, titanium, titanium alloys or alloys of any of
17 the foregoing; a glass insulator of the CABAL-12
18 composition type positioned around a portion of the
19 terminal and in sealing engagement therewith and a sleeve
20 or header consisting essentially of titanium or a
21 titanium alloy positioned around a portion of the glass
22 insulator for receiving same in sealing engagement
23 therewith.

24 4. The feedthrough of Claim 3 in which the
25 titanium alloy is Ti-6Al-4V.

26 5. An electrochemical cell of the type including
27 corrosive contents in a container and wherein the
28 container includes an opening carrying an electrical
29 terminal which extends from the exterior of the cell
30 through the opening and into the interior thereof; a
31 feedthrough assembly positioned in the opening and around
32 the terminal, the assembly comprising; a sleeve or header
33 attached to the container, the sleeve or header
34 consisting essentially of titanium or a titanium alloy

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1 and a glass seal carried by the sleeve or header and
2 surrounding the terminal in sealing engagement therewith,
3 the glass being of the CABAL-12 composition type.

4 6. The cell of Claim 5 in which the feedthrough
5 seal is hermetic and of the compression type by virtue of
6 including a terminal of niobium, tantalum, molybdenum,
7 titanium, a titanium alloy or any alloy or any of the
8 foregoing.

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Fig. 1

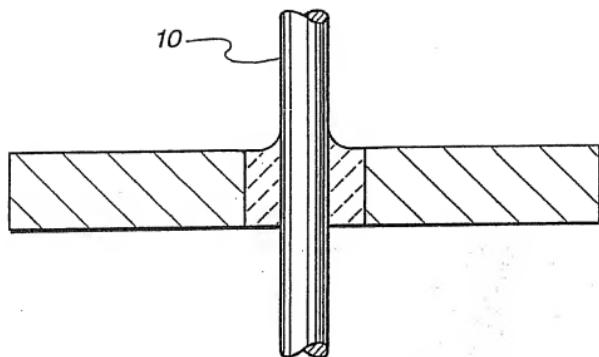
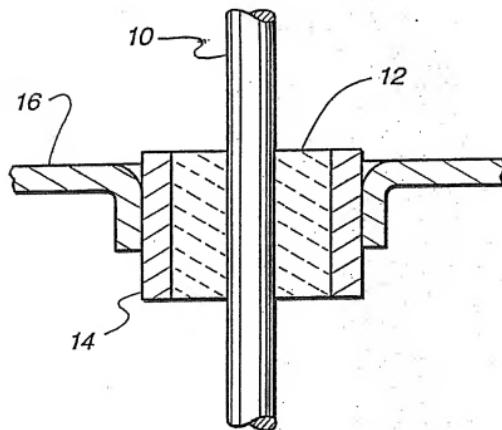


Fig. 2 V



INTERNATIONAL SEARCH REPORT

PCT/US90/05623

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ³

According to International Patent Classification (IPC) or to both National Classification and IPC.

INT(5): H01M 2/06 US CL.: 429/181

II. FIELDS SEARCHED

Minimum Documentation Searched ⁴

Classification System	Classification Symbol
US	429/181 174/152GM, 50, 61
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁵	

III. DOCUMENTS CONSIDERED TO BE RELEVANT ¹⁴

Category ⁶	Citation of Document, ¹⁵ with indication, where appropriate, of the relevant passage ¹⁷	Relevant to Claim No. ¹⁸
Y	US, A, 4,421,947 (KYLE) 20 December 1983 Col. 6, lines 21-32.	1-6
Y	US, A, 455,613 (TAYLOR ET AL.) 03 December 1985 Cols. 4 and 5, lines 62-100.	1-6
A	US, A, 4,180,700 (KRASKA ET AL.) 25 December 1979	
A	US, A, 4,271,278 (PHILLIPS ET AL.) 02 June 1981	
A	US, A, 4,307,162 (ATHEARN) 22 December 1981	
A	US, A, 4,678,868 (KRASKA ET AL.) 07 July 1987	
A	EP, A, 269,007 (HUBNER) 01 June 1988	
A	US, N, (RHEE) Wetting of Ceramics by Liquid Metal, Journal of the American Ceramic Society, pages 332-334, Vol. 54, No. 7.	
A	US, A, (BUNKER ET AL.) Development of Corrosion Resistant Glasses for Ambient Temperature Lithium Batteries, Sandia National Laboratories, 02 December 1981, pages 1-7.	
A	US, N, (BUNKER ET AL.) Ampule Tests to Simulate Glass Corrosion in Ambient Temperature Lithium Batteries, Vol. 2, Sandia Report SAND83-230 ₁ , June 1984.	

⁶ Special categories of cited documents: ¹⁵⁷ "A" document defining the general state of the art which is not considered to be of particular relevance⁸ "E" earlier document but published on or after the international filing date⁹ "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another claim for a special reason (as specified)¹⁰ "O" document referring to an oral disclosure, use, exhibition or other means¹¹ "P" document published prior to the international filing date but later than the priority date claimed¹² "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention¹³ "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step¹⁴ "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in that art¹⁵ "Z" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search ¹⁶

12 DECEMBER 1990

Date of Filing of this International Search Report ¹⁶

05 FEB 1991

International Searching Authority ¹⁷

ISA/US

Signature of Authorized Office ¹⁸

DONALD L. WALTON